Tanta University

Department: Computers and Control Eng.
Total Marks: 40 Marks

Faculty of Engineering

Course Title: **Decision Support Systems**	Course Code: **CCE32H4**	Year: **3rd** Computers
Date: **06/2016 (2nd term)**	Allowed time: **2:00 hr**	No. of Pages: (1)

Question (1) (Total 20 Marks)

1- Explain essential steps in the process of making a decision for a project establishment. **(4 Marks)**

2- State the factors affecting decision making. **(4 Marks)**

3- Define DSS, why DSS has evolved and state its benefits. **(4 Marks)**

4- What is a cognitive limits problem and suggest a solution. **(4 Marks)**

5- Solving a decision-making model involves searching for an appropriate course of action(a solution), state these search approaches. **(4 Marks)**

Question (2)(Total 20 Marks)

1- Define the following terms:
MIS – Expert systems – EIS – Data warehouse. **(4 Marks)**

2- What are the major components of DSS and briefly define each of them? **(4 Marks)**

3- Explain Simon's four phases of decision making. **(4 Marks)**

4- Galaxy Company manufactures two toy doll models: Space Ray and Zapper; where resources are limited to 1000 pounds of special plastic and 160 hours of production time per month.

- Marketing requirement
  - Total production cannot exceed 600 dozens.
  - Number of dozens of Space Rays cannot exceed number of dozens of Zappers by more than 200.
- Technological input
  - Space Rays requires 3 pounds of plastic and 2 minutes of labor per dozen.
  - Zappers requires 1 pound of plastic and 4 minutes of labor per dozen.

The current production plan calls for:

- Producing as much as possible of the more profitable product, Space Ray ($8 profit per dozen).
- Use resources left over to produce Zappers ($5 profit per dozen), while remaining within the marketing guidelines.

Management is seeking a production schedule that will increase the company's weekly profit.

a) Construct a linear programming model for this problem.
b) Find the optimal solution.

(4 Marks)

5- Explain the relationship between web and DSS. **(4 Marks)**

With my best wishes

Examiner: Dr. Mahmoud Alshewim

Course Title: **Artificial Intelligence and Expert Systems** Course Code: CCE3219 3rd year
Date: 2.6.2016 (Second term) Allowed time: 3 hrs

Answer the following questions:

Question No. 1 **(20 marks)**

For each of the following, please circle the letter introducing the best answer. (Check all that apply.)

1. A computer program is said to learn from experience E with respect to some task T and some performance measure P if its performance on T, as measured by P, improves with experience E. Suppose we feed a learning algorithm a lot of historical weather data, and have it learn to predict weather. In this setting, what is P?
   a) The process of the algorithm examining a large amount of historical weather data.
   b) The weather prediction task.
   c) The probability of it correctly predicting a future date's weather.
   d) None of these.
2. Let f be some function so that $f(\theta_0, \theta_1)$outputs a number. For this problem, f is some arbitrary/unknown smooth function (not necessarily the cost function of linear regression, so may have local optima). Suppose we use gradient descent to try to minimize $f(\theta_0, \theta_1)$ as a function of θ_0 and θ_1. Which of the following statements are true? (Check all that apply.)
   a) If the first few iterations of gradient descent cause $f(\theta_0, \theta_1)$ to increase rather than decrease, then the most likely cause is that we have set the learning rate α to too large a value.
   b) If θ_0 and θ_1 are initialized at a local minimum, the one iteration will not change their values.
   c) Even if the learning rate α is very large, gradient descent will decrease the value of $f(\theta_0, \theta_1)$.
   d) If the learning rate α is too small, then gradient descent may take a very long time to converge.
3. You're running a company, and you want to develop learning algorithms to address each of two problems.
   Problem 1: You have a large inventory of identical items. You want to predict how many of these items will sell over the next 3 months.
   Problem 2: You'd like software to examine individual customer accounts, and for each account decide if it has been hacked/compromised.
   Should you treat these as classification or as regression problems?
   a) Treat both as classification problems.
   b) Treat problem 1 as a classification problem, and problem 2 as a regression problem.
   c) Treat problem 2 as a classification problem, and problem 1 as a regression problem.
   d) Treat both as regression problems.

4. Suppose you have an un-labelled dataset. You run K-means with 50 different random initializations, and obtain 50 different clusters of the data. What is the recommended way for choosing which one of these 50 clusters to use?
   a) The answer is ambiguous, and there is no good way for choosing.
   b) Compute the distortion function and pick the one that minimizes it.
   c) Plot the data and the cluster centroids, and pick the clustering that gives the most "coherent" cluster centroids.
   d) The only way to do so is if we also have labels for our data.
5. Suppose you have a dataset with m=1000000 examples and n=15 features for each example. You want to use multivariate linear regression to fit the parameters to our data. Should you prefer gradient descent or the normal equation?
   a) The normal equation, since gradient descent might be unable to find the optimal θ.
   b) The normal equation, since it provides an efficient way to directly find the solution.
   c) Gradient descent, since it will always converge to the optimal θ.
   d) Gradient descent, since $(X^TX)^{-1}$ will be very slow to compute in the normal equation.
6. Backtracking in constraint satisfaction problems can be eliminated by:
   a) Forward Searching
   b) Constraint Propagation
   c) Backtrack after a forward search
   d) Omitting the constraints and focusing only on goals
7. The time and space complexity of DFS is (For time and space complexity problems consider b as the branching factor and m as the depth of the search tree.)
   a) O(bm) and $O(b^m)$
   b) $O(b^m)$ and $O(b^m)$
   c) $O(b^m)$ and O(bm)
   d) $O(m^b)$ and O(bm)
8. In A* approach evaluation function is
   a) Heuristic function
   b) Path cost from start node to current node
   c) Path cost from start node to current node + Heuristic cost
   d) Average of Path cost from start node to current node and Heuristic cost
9. Suppose you ran logistic regression twice, once with λ=1 and once with λ =0. One of the times, you got parameters $\theta = \begin{bmatrix} 74.81 \\ 45.05 \end{bmatrix}$, and the other time you got $\theta = \begin{bmatrix} 1.37 \\ 0.51 \end{bmatrix}$. However, you forgot which value of λ corresponds to which value of θ. Which one do you think corresponds to λ=1?
   a) $\theta = \begin{bmatrix} 1.37 \\ 0.51 \end{bmatrix}$

      $\theta = \begin{bmatrix} 74.81 \\ 45.05 \end{bmatrix}$

10. A navigation system that first considers all possible routes to the destination, and then selects the shortest route is described as:
    a) Reflex agent.
    b) Planning agent.
    c) Co-Agent
    d) Substituted Agent

Question No. 2 **(10 marks)**

Put (√) in front of the right statement and (×) in front of the wrong one, then correct it.

1. Feature scaling speeds up gradient descent by making it requires fewer iterations to get to a good solution.
2. A* search algorithm is a depth-first search with $h(n) = 0$.
3. Since we train one classifier when there are two classes, we train two classifiers when there are three classes (and we do one-vs-all classification).
4. Consider two different A* heuristics $h_1(s)$, and $h_2(s)$ that are each admissible. Combine the two heuristics into a single heuristic, using some function g. if $g = max(h_1(s), h_2(s))$ that will result in A* guaranteed to find the optimal solution while still guaranteeing admissibility.
5. A* graph search heuristics admissibility implies consistency.
6. Arc consistency detects failure earlier than forward checking.
7. Using too large value of λ can cause your hypothesis to overfit the data; this can be avoided by reducing λ.
8. Data driven reasoning or forward chaining is an inference technique which uses IF THEN rules to deduce a problem solution from initial data.
9. Breadth-first search is not optimal when all step costs are equal, because it always expands the shallowest unexpanded node.
10. A good way to initialize K-means is to select K (distinct) examples from the training set and set the cluster centroids equal to these selected examples.

Question No. 3 **(10 marks)**

You are in charge of scheduling for computer science classes that meet Mondays, Wednesdays and Fridays. There are 5 classes that meet on these days and 3 professors who will be teaching these classes. You are constrained by the fact that each professor can only teach one class at a time.

The classes are:
1. Class 1 - Intro to Programming: meets from 8:00-9:00am
2. Class 2 - Intro to Artificial Intelligence: meets from 8:30-9:30am
3. Class 3 - Natural Language Processing: meets from 9:00-10:00am
4. Class 4 - Computer Vision: meets from 9:00-10:00am
5. Class 5 - Machine Learning: meets from 10:30-11:30am
The professors are:
1. Professor A, who is qualified to teach Classes 1, 2, and 5.
2. Professor B, who is qualified to teach Classes 3, 4, and 5.
3. Professor C, who is qualified to teach Classes 1, 3, and 4.

1. Formulate this problem as a CSP problem in which there is one variable per class, state the domains, and constraints.
2. Draw the constraint graph associated with this CSP.
3. Use the tree structured algorithm to solve this CSP problem. Explain why we can use such algorithm to solve this problem.

Question No. 4 **(10 marks)**

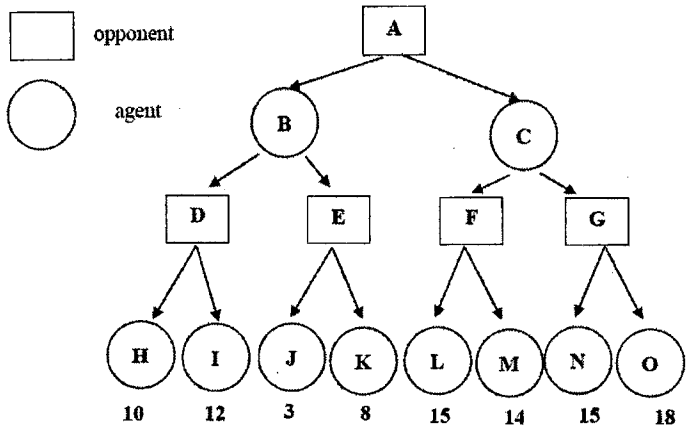
Nim is a two-player game. The game starts with a single stack of 7 tokens. At each move a player selects one stack and divides it into two non-empty, non-equal stacks. A player who is unable to move loses the game.

(a) Draw the complete search tree for nim.

(b) Assume two players, min and max, play nim (as described above). **Min plays first.** If a terminal state in the search tree developed above is a win for min, a utility function of zero is assigned to that state. A utility function of 1 is assigned to a state if max wins the game. Apply the min-max algorithm to the search tree to assign utility functions to all states in the search tree.

(c) If both min and max play a perfect game, who will win? Explain your answer.

(d) Given the following search tree, apply the alpha-beta pruning algorithm to it and show the search tree that would be built by this algorithm. Make sure that you show where the alpha and beta cuts are applied and which parts of the search tree are pruned as a result.



Question No. 5 **(20 marks)**

1. Illustrate with drawing the components of an Expert Systems and Mention **at least** three of their advantages and three of their limitations. (10 marks)

2. Use the k-means algorithm and Euclidean distance to cluster the following 8 examples into 3 clusters: A1=(2,10), A2=(2,5), A3=(8,4), A4=(5,8), A5=(7,5), A6=(6,4), A7=(1,2), A8=(4,9).

   The Euclidean distance is estimated using the equation:

   $$d((x_1, y_1), (x_2, y_2)) = \text{sqrt}((x_2-x_1)^2+(y_2-y_1)^2)).$$

Suppose that the initial centers of each cluster are A1, A4 and A7. Run the k-means algorithm for 1 epoch (iteration) only. At the end of this epoch show:

a) The new clusters (i.e. the examples belonging to each cluster) (4 marks)

b) The centres of the new clusters (3 marks)

c) How many more iterations are needed to converge? (3 marks)

Question No. 6 **(20 marks)**

1. Mention at least three differences between Supervised Learning and Un-Supervised Learning. (6 marks)

2. **Complete the following sentences**: (10 marks-each space is worth one degree)
   a. .....is a system that employs human knowledge captured in a computer to solve problems that ordinarily require human expertise.
   b. .....is a function that *estimates* how close a state is to a goal.
   c. .....is a special subset of search problems in which state is defined by variables with values from a domain and the goal test is a set of constraints specifying allowable combinations of values for variables.
   d. Depth-first search with variable-ordering and fail-on-violation is called .....
   e. Regarding arc consistency, if each single node's domain has a value which meets that node's unary constraint, then this node obeys.....
   f. .....means instantiate (in all ways) a set of variables such that the remaining constraint graph is a tree.
   g. .....is crossing off values that violate a constraint when added to the existing assignment
   h. .....is choosing the variable with the fewest legal left values in its domain.
   i. A* is optimal with ..... and ..... heuristics.

3. Suppose you have implemented regularized linear regression to predict housing prices. However, when you test your hypothesis in a new set of houses, you find that it makes unacceptably large errors in its prediction. When should you try each of the following options (with high bias or high variance problems)? (4 marks)
   a) Get more training examples
   b) Try increasing the degree of polynomial.
   c) Try decreasing λ.
   d) Try increasing λ.

Best wishes
Dr. Sherin El Gokhy

Tanta University

Department: Computers and Automatic Control Eng.
Total Marks: 90 Marks

Faculty of Engineering

Course Title: Software Engineering	Course Code:: CCE3218	Year:3rd
Date: May 28th 2016 (Second term)	Allowed time: 3 hrs	No. of Pages: (2)

Remarks: **Please Read the question more than once to fully understand it before you start solving, Do not forget to make verification and validation for your answers.**

Problem number (1) **(20 Marks)**

(a) ***"In the waterfall model, there is a backward flow"*****. Explain the need for this flow giving examples, and state the cost effect of this flow.** **(4 Marks)**

(b) You are a maintenance engineer and the users of given software came to you suffering from the next three distinct problems: **(8 Marks)**

1- The system's results are not correct.
2- The background image is inappropriate and it needs to be changed.
3- A new function that helps them to print the report is needed.

For each of the previous situations, specify the following (notice that they may differ in the action required):

i) **What type of maintenance is this?**
ii) **What caused this type of maintenance?**
iii) **In the future project, how can the company avoid each of these types?**

(c) What are the advantage and disadvantages of having custom software? Give an example of custom software. **(4 Marks)**

(d) How can you measure the software cost? How can you reduce this cost? **(4 Marks)**

Problem number (2) **(20 Marks)**

(a) In a SW designed as an operating system for a mobile, there are many tasks required. Decide at least 5 functions to be implemented and describe what they do. **(10 Marks)**

(b) Compare between the following pairs: **(6 Marks)**
1- In-house and hardware manufacturer. **2- Static and dynamic test techniques.**

(c) Provide three cases of why a project might not be technically feasible. **(4 Marks)**

Problem number (3) **(20 Marks)**

(a) Given the attached table describing the tasks inside a company. Draw PERT chart and state: **(6 Marks)**
1- What are the tasks done in parallel? **2- What is the last task?**
3- What is the total completion time? **4- What are the critical nodes?**

Task No.	Description	Duration (Days)	Predecessor Tasks
1	Develop Plan	1	-
2	Assign Tasks	4	1
3	Obtain Hardware	17	1
4	Programming	70	2
5	Install Hardware	10	3
6	Program Test	30	4
7	Write User Manual	25	5
8	Convert Files	20	5
9	System Test	25	6
10	User Training	20	7, 8
11	User Test	25	9,10

(b) Draw a decision table (or decision tree) for the following decision procedure for travelling to a place X:

"If the place you are travelling to is within 150 km, take your car; if the place is between 150 km and 600 km, take a train if the travel is for a holiday, and a plane otherwise; for travel over 600 km take a plane". (4 Marks)

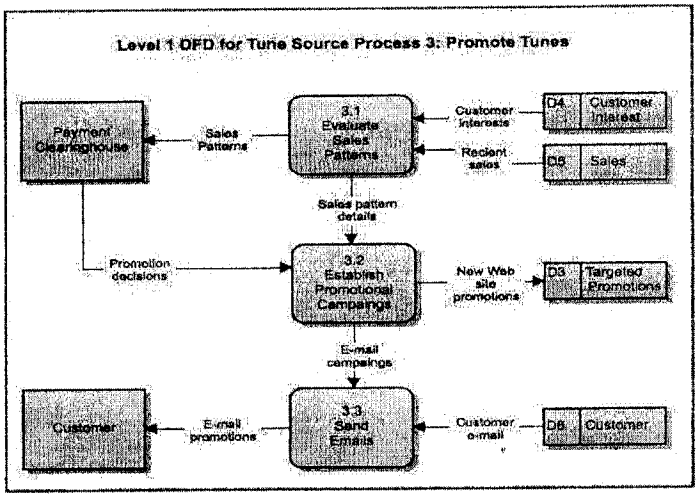
(c) What is a system prototype? When is the use of the prototype method most appropriate? (5 Marks)

(d) What is the type of questions preferred in a questionnaire? When will you conduct a questionnaire and when you use the user observation method to collect the requirement? (5 Marks)

Problem number (4) (30 Marks)

(a) In the following DFD, answer the following questions: (8 Marks)

1- What is this level?
2- How many tasks are there in the diagram? And what are there names?
3- What are the datastores available here?
4- What are the sources/sinks in the diagram?
5- Draw a higher level for this system and balance it with this level.



(b Compu-Fix is a computer repair company. The owner realises that a computer system would be a better method to save and access to this information about his work details. When a customer brings in a faulty computer, the employee must log the fault and the customer's details giving him/her an estimated date for the repair to be completed. Every day he checks the list of repairs and selects the jobs to be done that day. If he finds he doesn't have the required parts in stock for a repair he places a purchase order with his supplier and reschedules the job to a later date.

When a repair is complete and the customer comes to collect the computer, the employee gives him/her an invoice and the customer pays immediately.

Once a week, the owner checks his stock of parts, and orders any that are getting low in quantity from his supplier.

1- Determine the database needed to hold the customers data, faulty received computers data, and inventory computer parts data.
2- List the functions and what they exactly do that you would include in that system according to the description above and any added functions you desire (at least ten functions).
3- Explain the difference between functional and non-functional requirements. Give example for this application on hand.

(17 Marks)

c) What are the benefits of making software architecture before design? What are the famous designs required for a software? (5 Marks)

Good Luck all

Tanta University

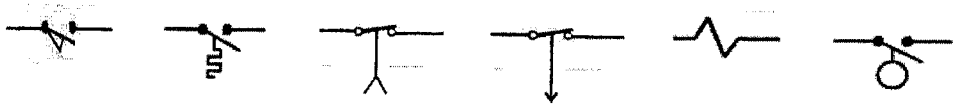
Department: Elec. Computers & Control Engineering
Total Marks: 85 Marks

Faculty of Engineering

Course Title: PLC	Course Code: CCE3223	Year: 3rd
Date: 12/6/2016	Allowed time: 3 hours	No. of Pages: (2)

Problem number (1) (23 Marks)

(a) i. Give a name for the following devices symbols and explain its usage.



ii. What are restrictions on programming with ladder diagram?

iii. Explain with draw the basic components of the relay, its operation and its connection with a 220v device.

iv. What is meant by PLC? What are the considerations you should take in choosing a PLC?

v. Escalator is an application example of using PLC; explain the role of PLC in this application.

(b) It's required to use only single push button switch to ON/OFF a lamp (When you push the button the first time, the lamp will be turned ON. Now, when you push the button for the second time, the lamp will be turned OFF). Draw the suitable ladder diagram to achieve this toggle function of push button switch. (8 Marks)

Problem number (2) (21 Marks)

(a) i. Explain the different methods that are used to program PLCs. (4 Marks)

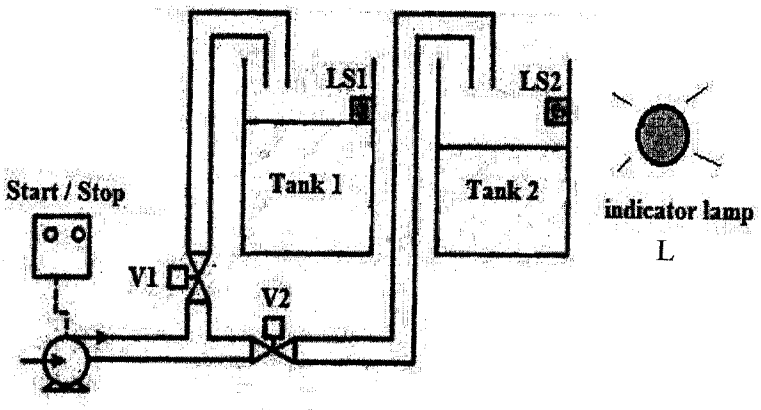
ii. What is meant by interlocks? Why we use interlocks in PLC programs. (3 Marks)

(b) Draw the ladder diagram that implements the following logic expressions: (6 Marks)

$$Y1 = A'\,B' + B\,(A\,D + C)$$
$$Y2 = (A\,B + E\,F')\,(C' + D)$$

(c) In the following figure we want to fill tank1 and tank2 with water by the following sequence:

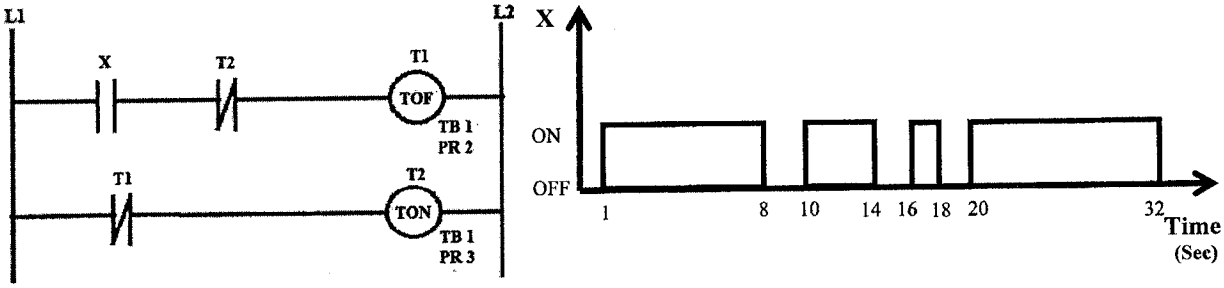
- When start switch is pressed, the valve (V1) opens to fill tank1 with water until it reaches to the desired level (via floating switch LS1).
- The valve (V2) waits 3 Sec, and then it opens to fill tank2 with water until it reaches to the desired level (via floating switch LS2).
- When tank2 is full, the system stops automatically and an indicator lamp (L) is turned on to show that the process of filling the two tanks is ended.
- There exists a stop switch to end the process at any emergency time. (8 Marks)



Problem number (3) (19 Marks)

(a) Explain the timing parameters of PLCs timers. (5 Marks)

(b) For the ladder diagram shown in the following figure, draw the timing diagram to illustrate the states of T1and T2. Consider the state of X as shown the following figure. (6 Marks)



(c) Draw a ladder diagram to control a traffic sign lights such that it changes automatically with the following sequence: (8 Marks)

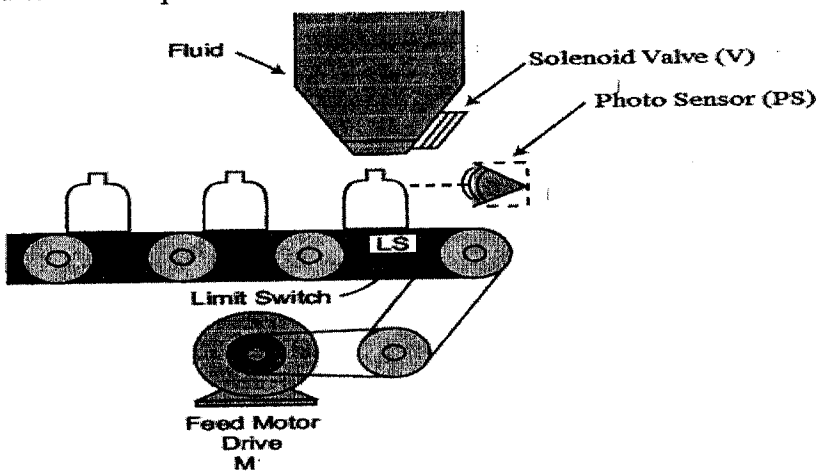
- Green light for 16 sec.
- Green and Yellow light for 5 sec.
- Red light for 13 sec.

Problem number (4) (22 Marks)

(a) Explain the main differences between timers and counters. (4 Marks)

(b) Draw a ladder diagram to control the entry and exit gates of a car parking system (garage) that has a maximum capacity of 30 cars. There are two gates in the garage: one for entry (G1) and another for exit (G2). Each time a car enters from G1, it will be added to the total sum of other cars in the garage. Each time a car exits from G2, it will be subtracted from the total sum of other cars in the garage. Two N.O. Limit switches are used: LS1 for G1 and LS2 for G2, to identify the cars that enter the garage or exit from it. When the garage is full (30 cars are parked in the garage), an indicator lamp (L) is turned ON. An external switch (XR) is used to reset the number of parked cars in the garage. (9 Marks)

(c) Draw a suitable ladder diagram program for a production line shown in the following figure. It detects the position of a bottle via a limit switch (LS), stops the motor (M) then, waits 2 sec and then opens the valve (V) to fill the bottle until a photo-sensor (PS) detects a filled condition. After the bottle is filled, waits 2 sec, then the motor (M) moves again to repeat these operations to the next bottle and so on. The production line should include start and stop push button switches to start and end these operations. (9 Marks)



Dr. M. Arafa

Good luck

Tanta University

Department: Computer and Automatic Control Engineering
Total Marks: 90 Marks

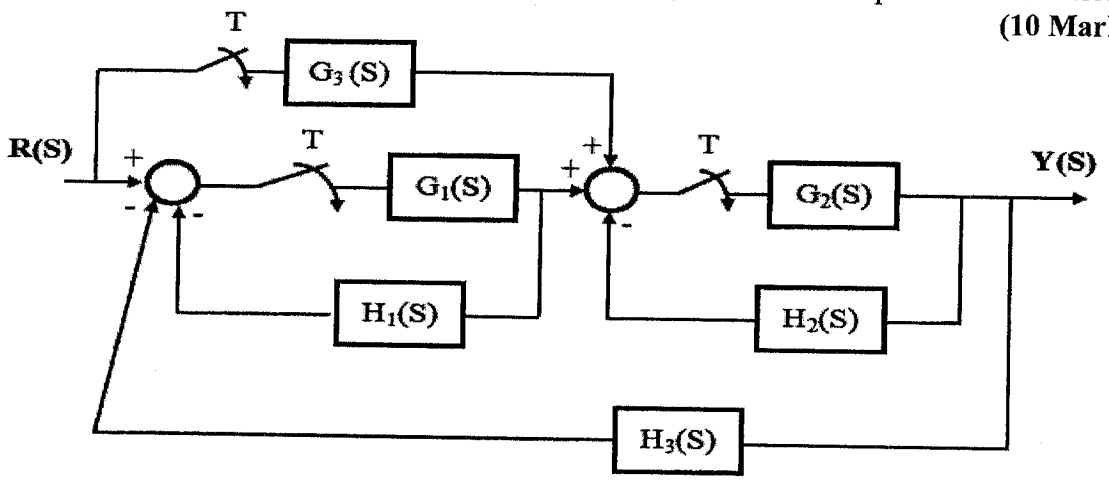
Faculty of Engineering

Course Title: Digital Control	Course Code: CCE3220	Year: 3rd
Date: 9/6/ 2016 (final exam)	Allowed time: 3 hours	No. of Pages: (2)

Answer the following questions.

Problem number (1) (20 Marks)

(a) For the following block diagram, find, if it exists, the closed loop transfer function: **(10 Marks)**

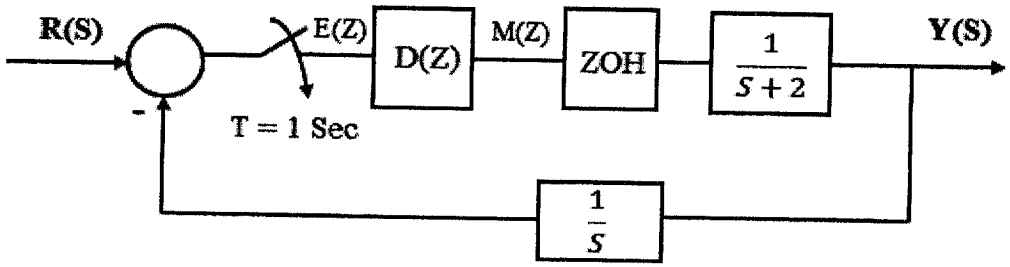


(b) For the following characteristic equation, check the stability of using Jury test or bilinear transformation: **(10 Marks)**

$$2Z^4 + 7Z^3 + 10Z^2 + 4Z + 1 = 0$$

Problem number (2) (18 Marks)

For the following feedback control system:



Where D(Z) is a digital filter described by the following difference equation:

$$m(k) = e(k) - e(k-1)$$

i. Determine the open loop transfer function
ii. Determine the closed loop transfer function
iii. Find the type and order of the system
iv. Calculate the system error constants
v. Calculate the steady state error for unit step input
vi. Find the initial and final value of the output for unit step input
vii. Check the system stability

Problem number (3) (20 Marks)

(b) For the system having the following open loop transfer function, Draw the Root Locus and find the value of K for critical stability. **(16 Marks)**

$$GH(z) = \frac{K(z+1)}{z\,(z-1)}$$

(b) Explain the meaning and usage of controllability and observability. **(4 Marks)**

Problem number (4) (32 Marks)

(a) Consider the following transfer function of a discrete-time system, **(8 Marks)**

$$\frac{Y(Z)}{R(Z)} = \frac{5\,Z}{(Z-0.5)(Z+1)(Z+0.5)}$$

i. Obtain the corresponding state space model in controllable form
ii. Draw the state diagram for this model

(b) The state-space representation of a continuous system is given by: **(8 Marks)**

$$\dot{x}(t) = \begin{bmatrix} 0 & 1 \\ 0 & -1 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$$

$$y(t) = [1 \quad 0]\, x(t)$$

Find the corresponding discrete-time state-space matrices (A_d, B_d, C_d) when a sampler with T=1Sec and ZOH are used.

(c) The discrete state space model of a discrete-time system is given as: **(16 Marks)**

$$x(k+1) = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix} x(k) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(k)$$

$$y(k) = [1 \quad 0]\, x(k)$$

i. Check the system controllability and observability.
ii. Using pole-placement design, find the gain matrix K that locates the desired closed-loop poles at $Z_{1,2} = 0.2 \pm j0.2$. (T = 1 Sec)
iii. Design a full order observer for the above system, with time constant $\tau = 10$ and damping ratio $\zeta = 1$. (T = 1 Sec)

Good luck

Tanta University
Final Term exam
Third year

Modeling and Simulation June 2016

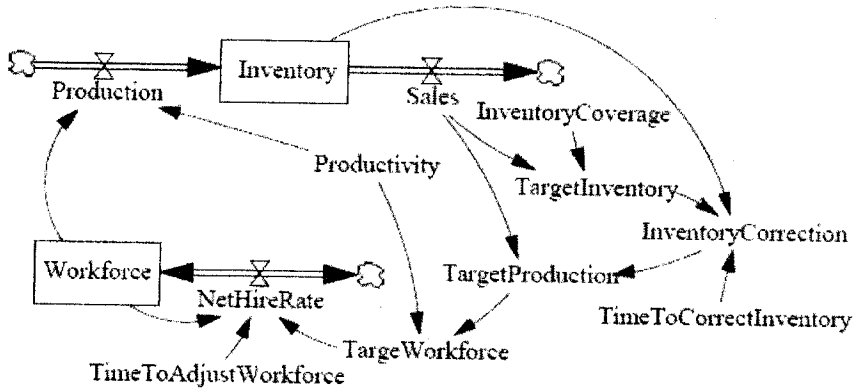
Faculty of Engineering
Computers and Automatic control
Time: Three hours

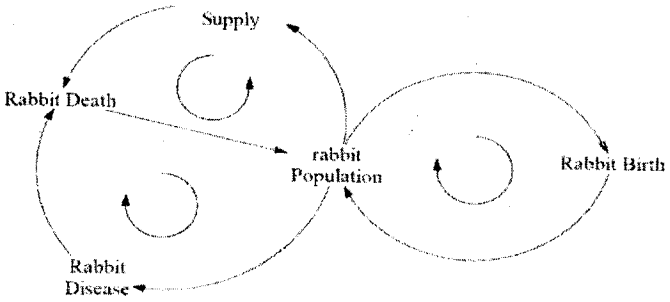
Answer all questions

Question one

1- For the following model

- What are the stocks, flows, constants and auxiliary variables
- Draw the causal loop diagram -Give three feedback loops in the model





2- For the above CLD put the logical sign for each loop, and then give the type of each rule

Question Two

PleaseA large pizza business makes pizzas and sells them. The pizzas are manufactured and kept in cold storage for not more than two weeks. The business is split into a number of functional units. There is Production Control, Manufacturing, Stores, Accounts, Sales, Shipping and Purchasing. Production Control are responsible for organizing which pizzas to produce in what order and in what quantity. They need to schedule the production of the pizzas according to the current and expected sales orders together with the number of pizzas already in Stores. Manufacturing take the raw materials from the Stores and manufacture pizzas returning the completed goods to the Stores. Accounts deal with the payments for the pizzas when delivered to the customer and the payment to the suppliers of the raw materials. Sales deal with customer orders whilst Purchasing organize the buying of raw material from suppliers. Shipping manage the packing and delivery of the goods to the customer with a delivery note.When a sales order is received by sales they record what is being ordered and by whom. They also record the details of the expected date of delivery. Production Control access this information and make sure that, if required, pizzas are produced by Manufacturing and are ready in Stores for when the delivery needs to be made. After the delivery is made Accounts make sure that the customer receives an invoice and that payment for the invoice is received at which time a receipt is issued. Purchasing look at the current stock of raw materials and by using current stock levels, supplier turnaround times and quantity to be ordered decide what needs to be ordered on a daily basis. Their aim is never to run out of an ingredient but to minimize the amount of raw material kept in stock.

- *Draw context diagram - Draw DFD for above case study*

Question Three

A engineering consultancy firm supplies temporary specialized staff to bigger companies in the country to work on their project for certain amount of time. The table below lists the time spent by each of the company's employees at other companies to carry out projects. The National Insurance Number (NIN) is unique for every member of staff.

NIN	Contract No	Hours	Employee Name	Company ID	Company Location
616681B	SC1025	72	P. White	SC115	Belfast
674315A	SC1025	48	R. Press	SC115	Belfast
323113B	SC1026	24	P. Smith	SC23	Bangor
616681B	SC1026	24	P. White	SC23	Bangor

a) Explain in which normal form this table is
b) Find the Primary Key for this relation and explain your choice.
c) Find the **Fully Functional Dependencies** on the PK and the **Partial Dependencies** on the PK.
d) Normalise the table to 2NF
e) Find the transitive dependencies on the 2NF tables

Question Four

1- Consider a small database for a company specialises on IT training. The database stores general information about students (stud_id, stud_name, grad_level), classes (class_id, class_name, units_earned), instructors (inst_id, inst_name, position), and grades (grad_id, stud_id, class_id, grad) in the following way.

- Classes can contain zero, one, or more students. Students are enrolled in zero, one, or more classes.
- Classes can be a prerequisite of zero, one, or more classes. In this case, a class can be both a normal class and a prerequisite class for another class.
- A class can be taught by one instructor and one instructor only. Each instructor can teach zero, one, or many classes.
- Instructors can give zero, one, or more grades. Grades can be given by zero, one, or more instructors.
- Students can receive zero, one, or more grades. Grades can be given to zero, one, or more students.
- Grades can come from one class and one class only. A class can have many grades earned from it.

Draw the E/R diagram, including the cardinality of the relationships

Question Five

1- A small shop has a single casher (payment point), the customers arrive to this point randomly . Between any two customers there is an Inter-arrival time between 1 and 5 minutes is shown in the following table

Time between Arrivals (min.)	Probability	Cumulative Probability	Random Numbers
1	0.2		
2	0.2		
3	0.2		
4	0.2		
5	0.2		

-At the following table the service time (between 1 to 5 minutes)

Service Time	Probability	Cumulative Probability	Random Numbers
1	0.10		
2	0.20		
3	0.25		
4	0.25		
5	0.20		

- Inter-arrival time for 14 customers

Customer	Random Number Generated	Time between Arrivals
1	0.869	
2	0.878	
3	0.623	
4	0.251	
5	0.074	
6	0.952	
7	0.440	
8	0.496	
9	0.878	
10	0.665	
11	0.054	
12	0.627	
13	0.087	
14	0.828	

- Service time for 14 customers

Customer	Random Number Generated	Service Times
1	0.769	
2	0.678	
3	0.623	
4	0.251	
5	0.174	
6	0.952	
7	0.446	
8	0.996	
9	0.878	
10	0.665	
11	0.954	
12	0.629	
13	0.087	
14	0.528	

a- Complete the missing in the all tables
b- Build the complete table for 14 customer simulation
c- Calculate the average waiting time for all customers
d- The probability of waiting in the queue